

Attachment 2

Kokomo and Wildcat Creeks

Background Sediment Summary



Background Sediment Evaluation of Kokomo and Wildcat Creeks

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This memorandum documents the data management and summarizes statistical evaluations performed on the background sediment sample results from Kokomo and Wildcat creeks, upstream of the Continental Steel Superfund Site. Background samples collected during previous investigations (1993 and 1995) were supplemented with data collected in July 2001. The first section documents data management procedures applied to generate files for statistical analyses. The second section summarizes data reproducibility in terms of field duplicate evaluations. The third section gives parameter-specific summaries for each creek and sets the stage for creek—parameter specific statistical evaluations of distribution testing and point-interval estimation (Section 4). Section 4 describes the objectives in the development of background estimates and how the estimates may best be applied in assessing site characterization data from the Continental Steel site.

1 Data Management

Issues requiring resolution prior to consolidation of historic and current background data into a single file for analysis included: integration of samples collected from differing depths at individual sample locations, resolution of multiple submittals of results from analytical laboratories, and evaluation of the comparability and consolidation of duplicate sample results. Table 1 presents the number of records in the database, the sample identifiers and record counts for three categories of sample types: (1) samples with either multiple dilutions reported for one or more individual parameters or multiple samples collected at different depths at a single location; (2) samples with documented field duplicate results; and, (3) stations with single results per parameter.

The following bullets summarize each of these and provides details on how each creeks data have been handled and where documentation resides.

Available Data

Original data files generated from the sitewide database consists of 1,058 records, 548 specific to Wildcat Creek and 510 to Kokomo Creek.

Multiple Depths/Reported Dilutions.

Two locations from Kokomo Creek (SD01 and SD02) and one location from Wildcat Creek (SD05) were sampled at multiple depths per location. Results from the two Kokomo Creek samples were reported twice from the analytical laboratory—once following routine sample preparation, and once following supplemental aliquot dilution. Dilution results have been eliminated. Had the qualifier submitted with the original sample been 'E,' the dilution result for that parameter would have replaced the reported concentration. Such was not the case for any of the sample results with *DL* following the sample identifier. Elimination of the *DL* results reduced the Kokomo database by 39 records.

Multiple depths at individual locations were collected only in July 2001. Previous investigations had included collection of depth-composited samples. To match previous efforts and to eliminate the biased effect of locations sampled at multiple depths, parameter results from different depths at the same location have been averaged. Consolidation of multiple depths has resulted in the reduction of the Kokomo and Wildcat creeks database by 48 and 25 records, respectively.

Table 1 documents the count of records that were included in the evaluation for samples from the two sites within each of the three categories. Record counts from samples with multiple depths or reported dilutions are 50 and 25 from Kokomo and Wildcat creeks, respectively. Singleton results from duplicated sample locations are 73 and 48 records, respectively. Finally, results from samples collected as 'singletons' account for additional sets of 168 and 266 records, respectively. Consolidation resulted in total record counts of 291 Kokomo Creek location-parameter specific sediment results and 339 Wildcat Creek sediment sample results. Location counts per creek are 12 and 14, respectively. The databases for Kokomo and Wildcat creeks used to evaluate background conditions are presented in Table 2a and 2b, respectively.

Attachment of critical values to the original sample results involved creation of a new parameter in the database, benzo(b&k)fluoranthene (BbkF), which consists of the sum of the reported benzo(b)fluoranthene (BBF) and benzo(k)fluoranthene (BKF) concentrations from each individual sample.

2 Duplicate Consolidation

Field duplicates are part of both historic and recent sediment sampling, as documented in the second category grouping in Table 1. Inclusion of both sets of sample duplicate results would artificially bias concentration levels occurring at the locations from which field duplicate results have been taken. Using a single set of results eliminates that bias. In the data summaries and statistical estimates described below, results from pairs of field duplicate results have been limited to the sample designated *N1*, eliminating results from the same location designated *FD1*.

Tables 3a and 3b list the 73 field duplicate pairs from Kokomo Creek and 48 field duplicate pairs from Wildcat Creek sediment sampling, respectively. The tables present the reported concentrations from the field duplicate (coded 'FD1,' with qualifier 'Q1') and the original sample (coded 'N1' with qualifier 'Q2'), the difference between the reported concentrations ('DIF' = 'FD1' – 'N1'), the mean of the two results, followed by the relative percent different, RPD. RPD is calculated as the ratio of the difference between the duplicate and original

samples, divided by the mean of the two results, times 100 to make the ratio a percentage. That value for each pair is found in the column designated *RPD*. The absolute difference (differences as positive values) is found in the following column, *absRPD*.

The two calculated values of *RPD* and *absRPD* provide slightly different interpretations of results. Ideally, *RPD* would average zero, assuming that there were no systematic difference between original and duplicate samples. Any consistent difference (such as *might* occur in the quantification of volatile organic compounds if the duplicate samples were consistently bottled last) would be of interest. The average *absRPD* gives a relative measure of internal consistency of small-scale spatial differences that may be compared to duplicate analyses of the same laboratory samples. The *RPD* results from the two sites are summarized as follows:

- Qualifier combinations from the paired results can occur in three combinations: DD, UU and DU (or UD), where D=detect and U=undetected qualifier for the two duplicate results. In the first two cases, both of the paired results have been reported as either detected at the reported concentration or not detected (undetect) at the detection limit. The final case (UD or DU) represents the two situations in which data qualifiers are discrepant, a situation most likely to occur at low concentrations, approaching the method limit of detection. Of the 73 field duplicate pairs collected in Kokomo Creek sediments, qualifiers from all but 5 (7 percent) are consistent (43 DD and 25 UU). Wildcat Creek results are less consistent with 9 discrepant qualifier pairs (representing 19 percent) and 15 DD and 25 UU pairs.
- The results presented in Tables 3a and 3b have been sorted by analytical class, qualifier pairs and absolute *RPD* (decreasing). The tables also include the average *RPD*, *absRPD* by analytical class. Results for the two creeks and three chemical classes are:

Chemical Class	Kokomo Creek		Wildcat Creek	
	Range RPD MEAN	Range AbsRPD MEAN	Range RPD MEAN	Range AbsRPD MEAN
Pesticide/PCB	-56 => 49 -0.9	2 => 56 7	-51 => 11 -2.8	=> 51 14
Semivolatile	-146 => 192 -14.5	0 => 192 77	-167 => 148 -5	=> 167 78
Metals	-25 => 6 -10	0 => 25 12	=> 20 16	=> 20 16

- As indicated, sites are generally comparable in terms of sampling error estimates.
- Semivolatile organic quantifications are comparatively more variable than either inorganic or pesticide/PCB quantifications. In the case of Wildcat Creek, the elevated semivolatile duplicates *RPDs* correspond to reported UD/DU results. In the case of Kokomo Creek, the qualifiers on the pairs resulting in the higher duplicate *RPDs* have been reported (both) as detected concentrations.
- Acceptable levels of analytical reproducibility (quantifications in two aliquots from the same sample) approach the *RPDs* in the above table, suggesting that, field duplicates are tolerably consistent.

3 Summary by Site

Sediment samples have been analyzed for up to 25 parameters, consisting of 2 metals, 7 PCBs (PPCB), and 16 PAH compounds. Two PAHs have been consolidated into a new measure, BbkF. Of the 26 parameters, 13 have remediation goals as presented in Table 4-6 of the final Feasibility Study report (CDM 1997), including Aroclors 1016, 1242, 1248, 1254 and 1260; benzo(a)anthracene (BAA), benzo(a)pyrene (BAP), BBF, BKF, BbkF, indeno(1,2,3-cd)pyrene (I123cdP), arsenic (AS), and beryllium (BE). Table 4 lists parameters, by chemical group, and documents applicable criterion, reporting units and counts per parameter in the two creek files. Sample counts are consistent within creek, with the exception of dibenzo(a,h)anthracene (DahA), which was quantified in only part of the samples collected in either creek.

The summary of background evaluation for Kokomo and Wildcat Creeks is presented in Tables 5a and 5b, respectively. Tabulated summaries include columns documenting:

- Chemical group, short parameter name and reporting units
- Detection fields (counts of samples detected, D; samples analyzed, N; and detection frequency, FD)
- Ranges of reported nondetects and detects (minimum, MIN, and maximum, MAX)
- Estimates of central tendency (arithmetic average or MEAN, where reported nondetects have been entered into the calculation at half the reported limit, or, MEDIAN)
- Remediation goals and comparisons to goals including the counts of reported detected result exceeding the critical value (D>) and counts of reported nondetects exceeding the critical value (U>)

The two summary tables are sorted by chemical group, followed by frequency of detection. Chemical group and parameter results for the two creeks are summarized below.

Kokomo Creek

- The two metals quantified in Kokomo Creek sediments occur in most samples analyzed, with beryllium and arsenic frequencies of detection (FD) 0.92 and 0.83, respectively. Critical values for the two have not been exceeded in either case.
- All 17 PAHs quantified in Kokomo Creek sediments were detected in at least 3 of the 12 samples collected. Twelve of the 17 PAHs (16 quantified, 1 calculated) have been detected in all samples collected from the creek. FDs for 4 other PAHs are somewhat lower but detected in 10 of the 12 samples analyzed. The final PAH, acenaphthylene, was detected in only 3 of the 12 samples. The critical values for the 6 PAHs with criteria have been exceeded in 5 to 10 of the 12 samples collected and analyzed. The reported detection limit of BbkF in one of the 12 samples exceeds the 1361 µg/kg criterion.
- A single PCB—Aroclor 1248—was detected in the creek sediments having been reported in detectable concentrations in 8 of the 12 samples collected. Reported nondetect levels of Aroclor 1248 exceed detected levels. Neither the maximum reported detect nor the maximum reporting limit exceeds the 1000 µg/kg criterion.

Wildcat Creek

- The two metals quantified in Wildcat Creek sediments, arsenic and beryllium, occur commonly with FDs of 93 and 79 percent, respectively. Beryllium levels are similar to levels observed in Kokomo Creek. However, arsenic levels in Wildcat Creek exceed those in Kokomo Creek, with one sample result exceeding the 19 mg/kg criterion.
- PAH detections are comparatively lower than in Kokomo Creek, with no FDs of 100 percent. Four PAHs have not been detected in any of the 14 Wildcat Creek sediment samples collected and quantified. FDs for the remaining 13 PAHs quantified range from a high of 79 percent down to 14 percent. None of either the reported detects or nondetects exceeds any applicable criterion.
- PCBs are slightly more common in Wildcat Creek samples (as compared to Kokomo Creek samples). However, presence of PCBs in the sediments is at both low frequencies and at low concentrations. In addition to Aroclor 1248, Aroclors 1254 and 1260 have been detected in one or two samples. The 1,000 µg/kg criterion (for each of 5 PAHs) has been exceeded in a single sample: SD-220 in OU3, which lies immediately downgradient from the slag processing area.

4 Statistical Estimators and Their Application

The object of the statistical summary of data from background samples collected from Wildcat and Kokomo creeks is to provide a basis for evaluating facility-specific results. To that end, three estimators were developed each with a slightly different interpretation and application. The three estimators include the estimates of central tendency, frequency of detection and upper tolerance limit, are briefly described, as follows:

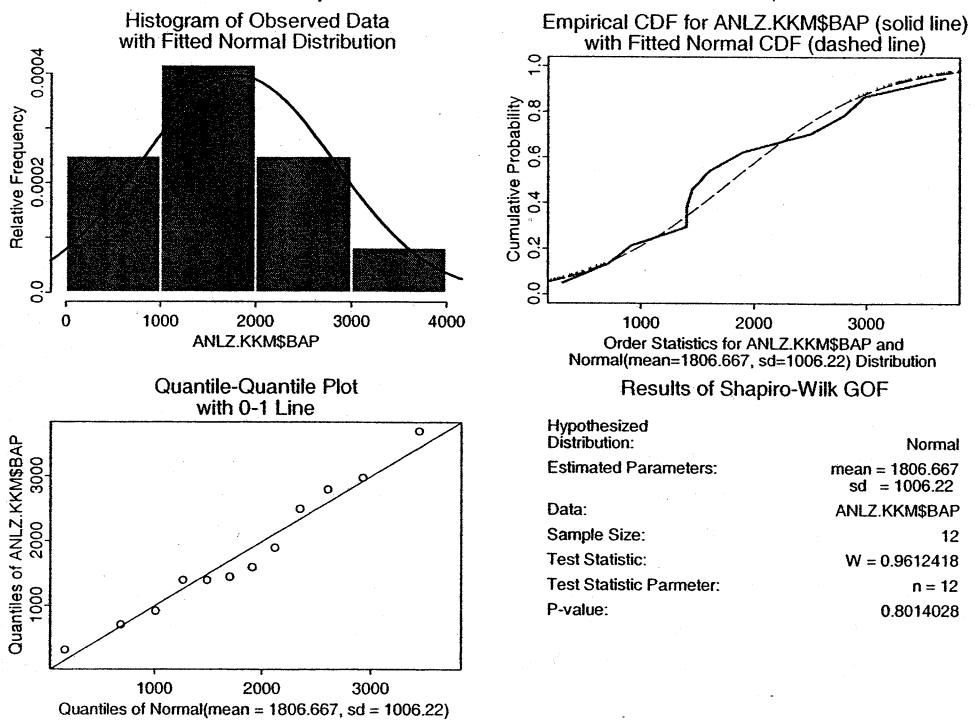
- The first is the estimate of central tendency. This is the center of the distribution of observed concentration results and is best-estimated with either a calculated mean or median concentration. The use of the mean or median depends upon the underlying distribution of observations. If data are normally distributed, the mean is an appropriate estimate. If data are not normally distributed, the median is a better estimate of central tendency. In either case, an uncertainty interval around the estimate has been used to establish an upper limit on the central value of the set of observations. The upper confidence limit used in this evaluation is the upper side of the two-sided 95 percent confidence interval for either the mean or median value, as appropriate.
- The second estimate is of the frequency of detection. The frequency of detection is a simple ratio of the counts of detected and total sample results. The uncertainty estimate or confidence interval on the frequency of detection gives an upper limit on what frequency of detection could be considered inconsistent with background conditions. While the frequency of detection is a less explicit estimate than either the central tendency or expected upper bound of actual concentrations, it is a useful estimator for parameters that do not naturally occur (i.e., occur at low frequencies of detection) but that are found in anthropogenically-affected areas such as industrial parks.
- The final estimator provided is the upper tolerance interval, UTL. A UTL is similar to the estimate of central tendency but rather than establishing the best-estimate of central tendency, it estimates the most representative concentration at the upper limit of the

distribution; in this case, the upper 95th percentile of the distribution of observed concentrations. Like the estimate of central tendency, the actual calculation is based upon the underlying distribution of observations. If data adhere to a normal distribution, normal equation calculations are used. If data do not follow a normal distribution, nonparametric methods, which make no assumptions about underlying distributions, are applied. As with the estimate of central tendency, a confidence interval about the UTL has been provided as an upper limit of expected background levels.

The underlying distribution of observed concentrations has been evaluated using the Shapiro-Wilk goodness-of-fit (GOF) test. The goodness-of-fit test quantifies the similarity of the observed concentrations, as compared to a theoretical normal distribution of the same sample size. Graphical devices such as histograms, quantile plots and cumulative density functions complement the results of the goodness-of-fit test in interpreting data distributions. A prototype of the output provided in the files is displayed below, for the benzo(a)pyrene (BAP) concentrations reported from Kokomo Creek.

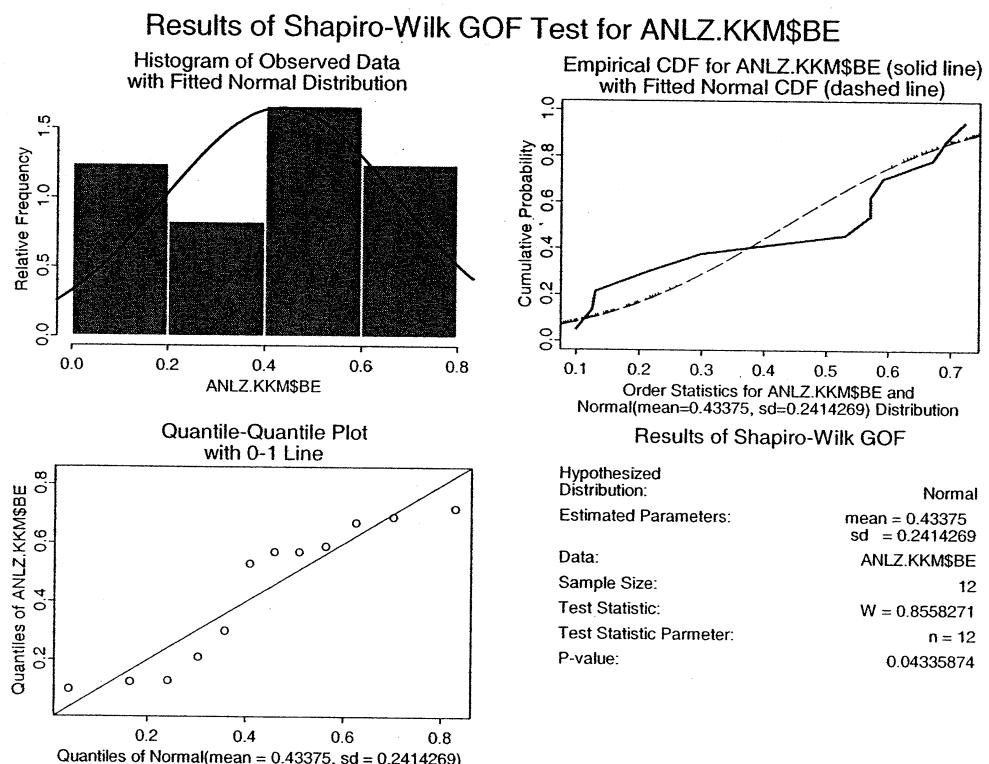
The panel consists of three plots and a small table. The upper left panel is a simple histogram of the 12 observed concentrations of BAP. The profile of histogram counts per concentration bin on the x-axis grossly follows the theoretical bell-shaped curve, indicated with the black line. In the lower left panel, the quantiles of the normal distribution have been plotted against the quantiles of the observed BAP concentrations. Points which fall on the diagonal indicate a good correspondence of the theoretical and observed values. Departures from the diagonal are good indications of where observations diverge from the theoretical distribution. In the case of BAP, while there is a slight slump in the center of the observations, the data, overall, fall on the diagonal, indicating a good approximation to a normal distribution. The upper right panel displays the cumulative density function of the theoretical normal distribution (broken line) and the observed BAP concentrations from

Results of Shapiro-Wilk GOF Test for ANLZ.KKM\$BAP



Kokomo Creek (solid line). Again, the discrepant mid-lying values are apparent while, overall, the lines overlap. The tabled results in the lower right corner of the display give the probability of the Shapiro-Wilk goodness-of-fit test. By convention, probabilities greater than 0.05 are considered to indicate an acceptably good 'fit' of the observations to the tested distribution. Here, the p-value of 0.80 indicates that the normal distribution is a good approximation for the observed BAP concentrations in Kokomo Creek.

Alternatively, the same set of plots displaying beryllium from Kokomo Creek sediments, indicates that beryllium is not normally distributed and that estimators are more appropriately based upon nonparametric methods.



Calculation details for the statistical estimators are found in the attached description of the Shapiro-Wilk tests. Tables 6a and 6b summarize results from the distribution testing for the 25 parameters quantified in background Kokomo and Wildcat Creek sediments, respectively. Creek-specific worksheets include columns which identify the analytical chemical group, the parameter (using an abbreviation), reporting units, followed by the goodness-of-fit test results and the selected distribution, either normal (coded 'N') or nonparametric (coded 'NP'). The statistical estimators follow, including: the expected frequency of detection and confidence limit (an upper limit if the expected FD is less than 1 or a lower limit if the expected FD is 1.0); the concentration of estimated central tendency, followed by the upper limit of a 2-sided 95 percent confidence interval; and the UTL and associated upper limit of a 2-sided 95 percent confidence interval on the 95th percentile of the background distribution of observations.

The UCLs tabled for the nonparametric central tendency and UTL estimates are followed by a bracketed percentage. That percentage indicates the level of confidence which could be

attained for the estimate, given the number of observations on which the interval is based. Because the nonparametric estimator is based upon observations and cannot exceed the maximum observed, the upper limit may, in fact, represent a reduced confidence in either the central tendency or UTL, based upon a limited sample size (such as the 12 to 14 samples collected from Kokomo and Wildcat Creeks). For example, in Table 6b, the UCL on the estimate of central tendency for arsenic 94 percent. However, the sample size of 14 observations is only sufficient to provide a 34 percent confidence interval on the 95th UTL (for arsenic).

The estimators provided are sufficient to identify expected values of frequency of detection, concentrations associated with central tendency and an upper bound for background levels in the two creeks upgradient from the Continental Steel Superfund Site. Comparison of onsite results, particularly in point-to-point comparison with either the central tendency or the upper bound should be used as approximations. Means testing or, population-to-population comparisons of background and site data, would require explicit tests such as either a t-test or nonparametric Wilcoxon rank sum test and/or quantile test to determine if site levels are statistically significantly different from background.

TABLE 1

Samples from Kokomo and Wildcat Creeks Used in Background Evaluation

Continental Steel Superfund Site

Creek	SiteId	Number of Records	Date	Type of Sample	StationId	SampleId	
1: Multiple Depths/Dilutions							
KOKOMO	CS2	25	07/16/2001	N1	SD01	CS2-SD01-0.0/1.0	
KOKOMO	CS2	23	07/16/2001	N1	SD01	CS2-SD01-0.0/1.0-DL	
KOKOMO	CS2	25	07/16/2001	N1	SD01	CS2-SD01-1.0/2.0	
KOKOMO	CS2	25	07/16/2001	N1	SD02	CS2-SD02-0.0/1.4	
KOKOMO	CS2	25	07/16/2001	N1	SD02	CS2-SD02-1.4/2.7	
KOKOMO	CS2	16	07/16/2001	N1	SD02	CS2-SD02-1.4/2.7-DL	
WILDCAT	CS2	25	07/16/2001	N1	SD05	CS2-SD05-0.0/1.5	
WILDCAT	CS2	25	07/16/2001	N1	SD05	CS2-SD05-1.5/2.7	
KKM		50		<i>Excludes DL-Resubmittals and Consolidates Multiple Depths</i>			
WLDCAT		25					
2: Field Duplicates							
KOKOMO	OU3	24	11/14/1995	FD1	BK-003	03BK00300104XD	
KOKOMO	OU3	24	11/14/1995	N1	BK-003	03BK00300104XX	
KOKOMO	OU3	24	08/03/1993	FD1	SD-001	03SD00100102XD	
KOKOMO	OU3	1	08/03/1993	FD1	SD-001	03SD00100102XDA	
KOKOMO	OU3	15	04/30/1993	N1	SD-001	03SD00100101XX	
KOKOMO	OU3	24	08/03/1993	N1	SD-001	03SD00100102XX	
KOKOMO	OU3	1	08/03/1993	N1	SD-001	03SD00100102XXA	
KOKOMO	CS2	25	07/16/2001	FD1	SD03	CS2-SD03R-0.0/0.5	
KOKOMO	CS2	25	07/16/2001	N1	SD03	CS2-SD03-0.0/0.5	
KOKOMO	OU3	15	06/07/1993	N1	SD-045	03SD04500101XX	
KOKOMO	OU3	24	08/03/1993	N1	SD-045	03SD04500102XX	
KOKOMO	OU3	1	08/03/1993	N1	SD-045	03SD04500102XXA	
WILDCAT	OU3	24	11/14/1995	FD1	BW-003	03BW00300104XD	
WILDCAT	OU3	24	11/14/1995	N1	BW-003	03BW00300104XX	
WILDCAT	OU3	15	05/01/1993	N1	SD-041	03SD04100101XX	
WILDCAT	OU3	24	08/04/1993	N1	SD-041	03SD04100102XX	
WILDCAT	OU3	1	08/04/1993	N1	SD-041	03SD04100102XXA	
WILDCAT	OU3	15	08/04/1993	N1	SD-041	03SD04100102XXR	
WILDCAT	OU3	15	06/07/1993	N1	SD-046	03SD04600101XX	
WILDCAT	OU3	24	08/04/1993	N1	SD-046	03SD04600102XX	
WILDCAT	OU3	1	08/04/1993	N1	SD-046	03SD04600102XXA	
WILDCAT	OU3	15	06/07/1993	N1	SD-047	03SD04700101XX	
WILDCAT	OU3	24	08/04/1993	N1	SD-047	03SD04700102XX	
WILDCAT	OU3	1	08/04/1993	N1	SD-047	03SD04700102XXA	
WILDCAT	OU3	24	11/15/1995	FD1	SD-221	03SD22100104XD	
WILDCAT	OU3	24	11/15/1995	N1	SD-221	03SD22100104XX	
KKM		73		<i>Excludes FD1/Includes N1[only]</i>			
WLDCAT		48					

TABLE 1

Samples from Kokomo and Wildcat Creeks Used in Background Evaluation

Continental Steel Superfund Site

Creek	SiteId	Number of Records	Date	Type of Sample	StationId	SampleId
3: Singleton Original Samples						
KOKOMO	OU3	24	11/14/1995	N1	BK-001	03BK00100104XX
KOKOMO	OU3	24	11/14/1995	N1	BK-002	03BK00200104XX
KOKOMO	OU3	24	11/14/1995	N1	BK-004	03BK00400104XX
KOKOMO	OU3	24	11/14/1995	N1	BK-005	03BK00500104XX
KOKOMO	OU3	24	11/14/1995	N1	BK-006	03BK00600104XX
KOKOMO	OU3	24	11/20/1995	N1	SD-226	03SD22600104XX
KOKOMO	OU3	24	11/20/1995	N1	SD-227	03SD22700104XX
WILDCAT	OU3	24	11/14/1995	N1	BW-001	03BW00100104XX
WILDCAT	OU3	24	11/14/1995	N1	BW-002	03BW00200104XX
WILDCAT	OU3	24	11/14/1995	N1	BW-004	03BW00400104XX
WILDCAT	OU3	24	11/14/1995	N1	BW-005	03BW00500104XX
WILDCAT	OU3	24	11/14/1995	N1	BW-006	03BW00600104XX
WILDCAT	CS2	25	07/17/2001	N1	SD04	CS2-SD04-0.0/1.9
WILDCAT	CS2	25	07/17/2001	N1	SD06	CS2-SD06-0.0/0.9
WILDCAT	OU3	24	11/20/1995	N1	SD-201	03SD20100104XX
WILDCAT	OU3	24	11/15/1995	N1	SD-220	03SD22000104XX
WILDCAT	OU3	24	11/15/1995	N1	SD-222	03SD22200104XX
WILDCAT	OU3	24	11/16/1995	N1	SD-223	03SD22300104XX
	KKM	168	<i>Includes All Results</i>			
	WLDCAT	266				
TOTALS	KKM	291				
	WLDCAT	339				

Notes:

CS2 = Samples collected during Geological Investigation (Contract 2) conducted by CH2M HILL in 2001

OU3 = Samples collected as part of the Remedial Investigation by ABB Environmental Services or Camp Dresser & McKee

N1 = Normal Sample

FD1 = Field Duplicate Sample

TABLE 2a
Database for Background Samples from Kokomo Creek
Continental/Steel/Superfund Site

SiteId	StationId	SampleId	Units	Bbkf	Q26	Acen	Q1	Acentyl	Q2	Anthr	Q3	AR01221	Q4
OU3	BK-001	03BK001000104XX	µg/kg	3400 F	380 F			580 T		900 F			240 T
OU3	BK-002	03BK00200104XX	µg/kg	4900 F	570 F			930 T		980 F			190 T
OU3	BK-003	03BK00300104XX	µg/kg	2800 F	260 F			28 F		550 F			180 T
OU3	BK-004	03BK00400104XX	µg/kg	1820 F	150 F			410 T		500 F			170 T
OU3	BK-005	03BK00500104XX	µg/kg	5300 F	400 F			1400 T		950 F			190 T
OU3	BK-006	03BK00600104XX	µg/kg	10800 F	1300 F			1800 T		2900 F			190 T
OU3	SD-001	03SD001000102XX	µg/kg	3000 F	160 F			860 T		380 F			87 T
CS2	SD01	CS2-SD01-MEAN	µg/kg	6040 F	930 F			154.5 F		1225 F			89 T
CS2	SD02	CS2-SD02-MEAN	µg/kg	4500 F	330 F			154.5 F		475 F			99.5 T
CS2	SD03	CS2-SD03-0.0/0.5	µg/kg	1540 F	110 F			400 T		370 F			81 T
OU3	SD-226	03SD22600104XX	µg/kg	1040 T	60 F			380 T		110 F			78 T
OU3	SD-227	03SD22700104XX	µg/kg	2070 T	290 F			470 T		500 F			96 T

TABLE 2a
**Database for Background Samples from Kokomo Creek
 Continental Steel Superfund Site**

Sitelid	ARO1016	Q5	ARO1232	Q6	ARO1242	Q7	ARO1248	Q8	ARO1254	Q9	ARO1260	Q10	AS	Q11	BAA
OU3	120 T	120 T	120 T	120 T	690 T	120 T	120 T	120 T	120 T	93 T	93 T	93 T	1.8 F	1.8 F	2100
OU3	93 T	93 T	93 T	93 T	410 F	93 T	410 F	93 T	93 T	90 T	90 T	90 T	4 F	4 F	2900
OU3	90 T	90 T	90 T	90 T	340 F	90 T	340 F	82 T	82 T	340 F	340 F	340 F	3.1 F	3.1 F	1400
OU3	82 T	82 T	82 T	82 T	340 F	82 T	340 F	390 F	390 F	92 T	92 T	92 T	3.4 F	3.4 F	1100
OU3	93 T	93 T	93 T	93 T	390 F	93 T	390 F	490 F	490 F	92 T	92 T	92 T	1.3 F	1.3 F	3000
OU3	92 T	92 T	92 T	92 T	490 F	92 T	490 F	43 T	43 T	43 T	43 T	43 T	1.6 F	1.6 F	7100
OU3	43 T	43 T	43 T	43 T	43.5 T	210 F	43.5 T	43.5 T	43.5 T	50 T	50 T	50 T	2.5 F	2.5 F	1500
CS2	43.5 T	43.5 T	43.5 T	43.5 T	43.5 T	40 T	40 T	230 F	230 F	40 T	40 T	40 T	1.4 F	1.4 F	3570
CS2	50 T	50 T	50 T	50 T	50 T	38 T	38 T	38 T	38 T	47 T	47 T	47 T	2.3 F	2.3 F	1450
CS2	40 T	40 T	40 T	40 T	40 T	38 T	38 T	38 T	38 T	47 T	47 T	47 T	1.1 F	1.1 F	960
OU3	38 T	38 T	38 T	38 T	38 T	47 T	47 T	47 T	47 T	47 T	47 T	47 T	1.1 T	1.1 T	350
OU3	47 T	47 T	47 T	47 T	47 T	47 T	47 T	47 T	47 T	47 T	47 T	47 T	7 T	7 T	1400

TABLE 2a
Database for Background Samples from Kokomo Creek
Continental Steel Superfund Site

SiteId		Q12	BAP	Q13	BBF	Q14	BE	Q15	BghiP	Q16	BKF	Q17	CHRYS	Q18	DahA	Q19	FLANTH	Q20	
OU3	F	1900	F	1900	F	0.57	F	830	F	1500	F	2300	F	2300	F	4200	F		
OU3	F	2800	F	2600	F	0.69	F	1300	F	2300	F	3200	F	6500	F				
OU3	F	1400	F	1400	F	0.67	F	330	F	1400	F	1700	F				3500	F	
OU3	F	920	F	840	F	0.72	F	86	F	980	F	1200	F					2500	F
OU3	F	2500	F	3000	F	0.53	F	270	F	2300	F	3600	F					7800	F
OU3	F	3700	F	5400	F	0.57	F	1800	T	5400	F	7600	F					15000	F
OU3	F	1400	F	1700	F	0.59	T	540	F	1300	F	1700	F					2800	F
OU3	F	2980	F	4655	F	0.125	F	1460	F	1385	F	4250	F					8500	F
CS2	F	1450	F	2500	F	0.21	F	920	F	2000	F	2150	F					690	F
CS2	F	710	F	1000	F	0.1	F	400	F	540	F	1300	F					370	F
CS2	F	320	F	660	F	0.13	F	380	T	380	T	380	F					3650	F
OU3	F	1600	F	1600	F	0.3	F	350	F	470	T	1900	F					2600	F
OU3	F																	5200	F

TABLE 2a
Database for Background Samples from Kokomo Creek
Continental Steel Superfund Site

Sitelid	FLENE	Q21	I123cdP	Q22	NAPH	Q23	PHEN	Q24	PYR	Q25
OU3	360 F	1000 F		580 T		3400 F		3900 F		
OU3	470 F	1700 F		79 F		4600 F		5600 F		
OU3	210 F	590 F		450 T		2200 F		2600 F		
OU3	230 F	520 F		410 T		2200 F		2200 F		
OU3	440 F	1600 F		1400 T		5600 F		6300 F		
OU3	1500 F	2700 F		180 F		13000 F		11000 F		
OU3	200 F	630 F		860 T		1800 F		2900 F		
CS2	1085 F	2165 F		240 F		8150 F		7800 F		
CS2	305 F	1150 F		500 T		2200 F		3400 F		
CS2	190 F	520 F		400 T		1700 F		2100 F		
OU3	55 F	120 F		380 T		660 F		1200 F		
OU3	240 F	460 F		27 F		3300 F		6800 F		

WLDCAT

TABLE 2b
Database for Background Samples from Wildcat Creek
Continental Steel Superfund Site

SiteId	StationId	SampleId	SOURCE	Units	BbkF	Q26	ACEN	Q1	ACENTHYL	Q2	ANTHR	Q3	AR01221	Q4
OU3	BW-001	03BW0010C SINGLES	µg/kg	820	T	410	T	410	T	410	T	84	T	
OU3	BW-002	03BW0020C SINGLES	µg/kg	126	F	420	T	420	T	420	T	85	T	
OU3	BW-003	03BW0030C DUPES	µg/kg	70	F	420	T	420	T	420	T	85	T	
OU3	BW-004	03BW0040C SINGLES	µg/kg	199	F	450	T	450	T	33	F	92	T	
OU3	BW-005	03BW0050C SINGLES	µg/kg	1040	F	510	T	510	T	110	F	100	T	
OU3	BW-006	03BW0060C SINGLES	µg/kg	222	F	420	T	420	T	24	F	85	T	
CS2	SD04	CS2-SD04-(SINGLES	µg/kg	840	T	420	T	420	T	420	T	85	T	
CS2	SD05	CS2-SD05-(NZ	µg/kg	632.5	F	530	T	530	T	530	T	110	T	
CS2	SD06	CS2-SD06-(SINGLES	µg/kg	840	T	420	T	420	T	420	T	85	T	
OU3	SD-201	03SD20100 SINGLES	µg/kg	136	F	440	T	440	T	440	T	90	T	
OU3	SD-220	03SD22000 SINGLES	µg/kg	920	T	460	T	460	T	460	T	93	T	
OU3	SD-221	03SD22100 DUPES	µg/kg	180	F	700	T	700	T	700	T	140	T	
OU3	SD-222	03SD22200 SINGLES	µg/kg	1210	F	410	T	410	T	160	F	420	T	
OU3	SD-223	03SD22300 SINGLES	µg/kg	720	F	400	T	400	T	140	F	82	T	

TABLE 2b
Database for Background Samples from Wildcat Creek
Continental Steel Superfund Site

Sitelid	ARO1016	Q5	ARO1232	Q6	ARO1242	Q7	ARO1248	Q8	ARO1254	Q9	ARO1260	Q10	AS	Q11	BAA
OU3	41	T	4.9	F	410										
OU3	42	T	2.9	F	420										
OU3	42	T	4.7	F	420										
OU3	45	T	45	T	45	T	95	F	45	T	45	T	13.9	F	70
OU3	51	T	3	F	430										
OU3	42	T	6.9	F	94										
CS2	42	T	1.9	F	420										
CS2	53	T	53	T	53	T	59	F	53	T	53	T	32.25	F	310
CS2	42	T	4.5	F	420										
OU3	44	T	2.3	T	62										
OU3	46	T	46	T	46	T	2000	F	1600	F	720	F	3.7	F	460
OU3	70	T	70	T	70	T	70	T	370	F	70	T	6	F	700
OU3	210	T	13.9	F	570										
OU3	40	T	3.5	F	360										

WLDCAT

TABLE 2b
Database for Background Samples from Wildcat Creek
Continental Steel Superfund Site

Sitelid	Q12	BAP	Q13	BBF	Q14	BE	Q15	BghiP	Q16	BKF	Q17	CHRYS	Q18	Daha	Q19	Flanth	Q20
OU3	T	410	T	410	T	0.45	F	410	T	410	T	410	T	410	T	47	F
OU3	T	420	T	70	F	0.53	F	420	T	56	F	420	T	160	F		
OU3	T	420	T	43	F	0.49	F	420	T	27	F	47	F	91	F		
OU3	F	450	T	99	F	0.58	F	450	T	100	F	120	F	230	F		
OU3	F	710	F	500	F	0.54	F	510	T	540	F	700	F	1200	F		
OU3	F	100	F	130	F	0.48	F	71	F	92	F	160	F	310	F		
CS2	T	230	F	420	T	0.21	F	420	T	420	T	420	T	420	T	420	T
CS2	F	338.5	F	330	F	0.43	F	305	F	302.5	F	345	F	530	T	410	F
CS2	T	420	T	420	T	0.19	F	420	T	420	T	420	T	420	T	420	T
OU3	F	440	T	76	F	0.23	F	440	T	60	F	93	F	180	F		
OU3	T	460	T	460	T	0.31	T	460	T	460	T	460	T	460	T		
OU3	T	77	F	97	F	0.57	F	700	T	83	F	700	T	190	F		
OU3	F	560	F	630	F	0.24	T	230	F	580	F	620	F	2500	F		
OU3	F	360	F	340	F	0.24	T	100	F	380	F	400	F	1500	F		

TABLE 2b
Database for Background Samples from Wildcat Creek
Continental Steel Superfund Site

Sitelid	FLENE	Q21	I123cdP	Q22	NAPH	Q23	PHEN	Q24	PYR	Q25
OU3	410	T	410	T	410	T	22	F	42	F
OU3	420	T	48	F	420	T	89	F	150	F
OU3	420	T	420	T	420	T	44	F	130	F
OU3	450	T	66	F	450	T	79	F	230	F
OU3	43	F	410	F	510	T	600	F	1400	F
OU3	420	T	79	F	420	T	150	F	280	F
CS2	420	T	420	T	420	T	420	T	420	T
CS2	530	T	310	F	530	T	345	F	395	F
CS2	420	T	420	T	420	T	420	T	420	T
OU3	440	T	440	T	440	T	98	F	230	F
OU3	460	T	460	T	460	T	460	T	460	T
OU3	700	T	700	T	700	T	700	T	700	T
OU3	63	F	240	F	410	T	1000	F	1000	F
OU3	400	T	160	F	400	T	730	F	740	F

TABLE 3a

Duplicate Relative Percent Difference for Kokomo Creek Samples
Continental Steel Superfund Site

StationId	CLASS	PARAMETER	FD1	Q1	N1	Q2	QQ	DIF	MEAN	RPD	absRPD
SD03	PPCB	Aroclor-1248	130	D	230	D	DD	-100	180	-55.6	55.6
BK-003	PPCB	Aroclor-1248	560	D	340	D	DD	220	450	48.9	48.9
SD03	PPCB	Aroclor-1016	41	U	40	U	UU	1	40.5	2.5	2.5
SD03	PPCB	Aroclor-1232	41	U	40	U	UU	1	40.5	2.5	2.5
SD03	PPCB	Aroclor-1242	41	U	40	U	UU	1	40.5	2.5	2.5
SD03	PPCB	Aroclor-1254	41	U	40	U	UU	1	40.5	2.5	2.5
SD03	PPCB	Aroclor-1260	41	U	40	U	UU	1	40.5	2.5	2.5
SD03	PPCB	Aroclor-1221	83	U	81	U	UU	2	82	2.4	2.4
SD-001	PPCB	Aroclor-1016	42	U	43	U	UU	-1	42.5	-2.4	2.4
SD-001	PPCB	Aroclor-1232	42	U	43	U	UU	-1	42.5	-2.4	2.4
SD-001	PPCB	Aroclor-1242	42	U	43	U	UU	-1	42.5	-2.4	2.4
SD-001	PPCB	Aroclor-1248	42	U	43	U	UU	-1	42.5	-2.4	2.4
SD-001	PPCB	Aroclor-1254	42	U	43	U	UU	-1	42.5	-2.4	2.4
SD-001	PPCB	Aroclor-1260	42	U	43	U	UU	-1	42.5	-2.4	2.4
SD-001	PPCB	Aroclor-1221	85	U	87	U	UU	-2	86	-2.3	2.3
BK-003	PPCB	Aroclor-1016	88	U	90	U	UU	-2	89	-2.2	2.2
BK-003	PPCB	Aroclor-1232	88	U	90	U	UU	-2	89	-2.2	2.2
BK-003	PPCB	Aroclor-1242	88	U	90	U	UU	-2	89	-2.2	2.2
BK-003	PPCB	Aroclor-1254	88	U	90	U	UU	-2	89	-2.2	2.2
BK-003	PPCB	Aroclor-1260	88	U	90	U	UU	-2	89	-2.2	2.2
BK-003	PPCB	Aroclor-1221	180	U	180	U	UU	0	180	0.0	0.0
										-0.9	7.0
SD-001	SV	Anthracene	60	D	380	D	DD	-320	220	-145.5	145.5
SD-001	SV	Benzo(a)Pyrene	230	D	1400	D	DD	-1170	815	-143.6	143.6
SD-001	SV	Benzo(a)Anthracene	270	D	1500	D	DD	-1230	885	-139.0	139.0
SD-001	SV	Phenanthrene	350	D	1800	D	DD	-1450	1075	-134.9	134.9
SD-001	SV	Benzo(b)Fluoranthene	340	D	1700	D	DD	-1360	1020	-133.3	133.3
SD-001	SV	Chrysene	370	D	1700	D	DD	-1330	1035	-128.5	128.5
SD-001	SV	Pyrene	650	D	2900	D	DD	-2250	1775	-126.8	126.8
SD-001	SV	Indeno(1,2,3-cd)pyrene	150	D	630	D	DD	-480	390	-123.1	123.1
SD-001	SV	Benzo(k)Fluoranthene	310	D	1300	D	DD	-990	805	-123.0	123.0
SD-001	SV	Fluoranthene	740	D	2800	D	DD	-2060	1770	-116.4	116.4
BK-003	SV	Indeno(1,2,3-cd)pyrene	1900	D	590	D	DD	1310	1245	105.2	105.2
BK-003	SV	Pyrene	7300	D	2600	D	DD	4700	4950	94.9	94.9
BK-003	SV	Phenanthrene	5600	D	2200	D	DD	3400	3900	87.2	87.2
BK-003	SV	Benzo(a)Pyrene	3500	D	1400	D	DD	2100	2450	85.7	85.7
BK-003	SV	Benzo(g,h,i)Perylene	760	D	330	D	DD	430	545	78.9	78.9
BK-003	SV	Chrysene	3900	D	1700	D	DD	2200	2800	78.6	78.6
BK-003	SV	Benzo(a)Anthracene	3200	D	1400	D	DD	1800	2300	78.3	78.3
BK-003	SV	Fluoranthene	7900	D	3500	D	DD	4400	5700	77.2	77.2
BK-003	SV	Benzo(k)Fluoranthene	2900	D	1400	D	DD	1500	2150	69.8	69.8
BK-003	SV	Fluorene	420	D	210	D	DD	210	315	66.7	66.7
SD03	SV	Anthracene	190	D	370	D	DD	-180	280	-64.3	64.3
SD03	SV	Phenanthrene	890	D	1700	D	DD	-810	1295	-62.5	62.5
SD03	SV	Chrysene	690	D	1300	D	DD	-610	995	-61.3	61.3
BK-003	SV	Acenaphthene	470	D	260	D	DD	210	365	57.5	57.5

TABLE 3a

Duplicate Relative Percent Difference for Kokomo Creek Samples
Continental Steel Superfund Site

StationId	CLASS	PARAMETER	FD1	Q1	N1	Q2	QQ	DIF	MEAN	RPD	absRPD
BK-003	SV	Benzo(b)Fluoranthene	2500	D	1400	D	DD	1100	1950	56.4	56.4
BK-003	SV	Anthracene	980	D	550	D	DD	430	765	56.2	56.2
SD03	SV	Benzo(a)Anthracene	540	D	960	D	DD	-420	750	-56.0	56.0
SD03	SV	Pyrene	1200	D	2100	D	DD	-900	1650	-54.5	54.5
SD03	SV	Fluoranthene	1500	D	2600	D	DD	-1100	2050	-53.7	53.7
SD03	SV	Fluorene	110	D	190	D	DD	-80	150	-53.3	53.3
SD03	SV	Dibenzo(a,h)anthracene	140	D	230	D	DD	-90	185	-48.6	48.6
SD03	SV	Benzo(b)Fluoranthene	620	D	1000	D	DD	-380	810	-46.9	46.9
SD03	SV	Benzo(a)Pyrene	460	D	710	D	DD	-250	585	-42.7	42.7
SD03	SV	Indeno(1,2,3-cd)pyrene	360	D	520	D	DD	-160	440	-36.4	36.4
SD03	SV	Benzo(k)Fluoranthene	380	D	540	D	DD	-160	460	-34.8	34.8
SD03	SV	Benzo(g,h,i)Perylene	320	D	400	D	DD	-80	360	-22.2	22.2
SD03	SV	Acenaphthene	110	D	110	D	DD	0	110	0.0	0.0
BK-003	SV	Acenaphthylene	1300	U	28	D	UD	1272	664	191.6	191.6
SD-001	SV	Acenaphthene	420	U	160	D	UD	260	290	89.7	89.7
SD-001	SV	Fluorene	420	U	200	D	UD	220	310	71.0	71.0
SD-001	SV	Benzo(g,h,i)Perylene	420	U	540	D	UD	-120	480	-25.0	25.0
BK-003	SV	Naphthalene	1300	U	450	U	UU	850	875	97.1	97.1
SD-001	SV	Acenaphthylene	420	U	860	U	UU	-440	640	-68.8	68.8
SD-001	SV	Naphthalene	420	U	860	U	UU	-440	640	-68.8	68.8
SD03	SV	Acenaphthylene	410	U	400	U	UU	10	405	2.5	2.5
SD03	SV	Naphthalene	410	U	400	U	UU	10	405	2.5	2.5
										-14.5	77.4
SD03	tMTL	Arsenic	0.86	D	1.1	D	DD	-0.24	0.98	-24.5	24.5
SD-001	tMTL	Arsenic	2	D	2.5	D	DD	-0.5	2.25	-22.2	22.2
BK-003	tMTL	Beryllium	0.71	D	0.67	D	DD	0.04	0.69	5.8	5.8
BK-003	tMTL	Arsenic	3	D	3.1	D	DD	-0.1	3.05	-3.3	3.3
SD03	tMTL	Beryllium	0.1	U	0.1	D	UD	0	0.1	0.0	0.0
SD-001	tMTL	Beryllium	0.51	U	0.59	U	UU	-0.08	0.55	-14.5	14.5
										-9.8	11.7

TABLE 3b

Duplicate Relative Percent Difference for Wildcat Creek Samples

Continental Steel Superfund Site

StationId	CLASS	PARAMETER	FD1	Q1	N1	Q2	QQ	DIF	MEAN	RPD	ABSRPD
SD-221	PPCB	Aroclor-1254	220	D	370	D	DD	-150	295	-50.8	50.8
BW-003	PPCB	Aroclor-1221	96	U	85	U	UU	11	90.5	12.2	12.2
SD-221	PPCB	Aroclor-1016	62	U	70	U	UU	-8	66	-12.1	12.1
SD-221	PPCB	Aroclor-1232	62	U	70	U	UU	-8	66	-12.1	12.1
SD-221	PPCB	Aroclor-1242	62	U	70	U	UU	-8	66	-12.1	12.1
SD-221	PPCB	Aroclor-1248	62	U	70	U	UU	-8	66	-12.1	12.1
SD-221	PPCB	Aroclor-1260	62	U	70	U	UU	-8	66	-12.1	12.1
BW-003	PPCB	Aroclor-1016	47	U	42	U	UU	5	44.5	11.2	11.2
BW-003	PPCB	Aroclor-1232	47	U	42	U	UU	5	44.5	11.2	11.2
BW-003	PPCB	Aroclor-1242	47	U	42	U	UU	5	44.5	11.2	11.2
BW-003	PPCB	Aroclor-1248	47	U	42	U	UU	5	44.5	11.2	11.2
BW-003	PPCB	Aroclor-1254	47	U	42	U	UU	5	44.5	11.2	11.2
BW-003	PPCB	Aroclor-1260	47	U	42	U	UU	5	44.5	11.2	11.2
SD-221	PPCB	Aroclor-1221	130	U	140	U	UU	-10	135	-7.4	7.4
										-2.8	14.2
BW-003	SV	Benzo(k)Fluoranthene	180	D	27	D	DD	153	103.5	147.8	147.8
BW-003	SV	Benzo(b)Fluoranthene	250	D	43	D	DD	207	146.5	141.3	141.3
BW-003	SV	Chrysene	270	D	47	D	DD	223	158.5	140.7	140.7
BW-003	SV	Fluoranthene	520	D	91	D	DD	429	305.5	140.4	140.4
BW-003	SV	Phenanthrene	240	D	44	D	DD	196	142	138.0	138.0
BW-003	SV	Pyrene	430	D	130	D	DD	300	280	107.1	107.1
SD-221	SV	Benzo(b)Fluoranthene	200	D	97	D	DD	103	148.5	69.4	69.4
SD-221	SV	Benzo(a)Pyrene	150	D	77	D	DD	73	113.5	64.3	64.3
SD-221	SV	Benzo(k)Fluoranthene	150	D	83	D	DD	67	116.5	57.5	57.5
SD-221	SV	Fluoranthene	240	D	190	D	DD	50	215	23.3	23.3
SD-221	SV	Benzo(g,h,i)Perylene	64	D	700	U	UD	-636	382	-166.5	166.5
BW-003	SV	Anthracene	42	D	420	U	UD	-378	231	-163.6	163.6
SD-221	SV	Phenanthrene	70	D	700	U	UD	-630	385	-163.6	163.6
SD-221	SV	Indeno(1,2,3-cd)pyrene	110	D	700	U	UD	-590	405	-145.7	145.7
SD-221	SV	Benzo(a)Anthracene	120	D	700	U	UD	-580	410	-141.5	141.5
SD-221	SV	Chrysene	190	D	700	U	UD	-510	445	-114.6	114.6
BW-003	SV	Indeno(1,2,3-cd)pyrene	120	D	420	U	UD	-300	270	-111.1	111.1
SD-221	SV	Pyrene	250	D	700	U	UD	-450	475	-94.7	94.7
BW-003	SV	Benzo(a)Anthracene	160	D	420	U	UD	-260	290	-89.7	89.7
SD-221	SV	Acenaphthene	620	U	700	U	UU	-80	660	-12.1	12.1
SD-221	SV	Acenaphthylene	620	U	700	U	UU	-80	660	-12.1	12.1
SD-221	SV	Anthracene	620	U	700	U	UU	-80	660	-12.1	12.1
SD-221	SV	Fluorene	620	U	700	U	UU	-80	660	-12.1	12.1
SD-221	SV	Naphthalene	620	U	700	U	UU	-80	660	-12.1	12.1
BW-003	SV	Acenaphthene	470	U	420	U	UU	50	445	11.2	11.2
BW-003	SV	Acenaphthylene	470	U	420	U	UU	50	445	11.2	11.2
BW-003	SV	Benzo(a)Pyrene	470	U	420	U	UU	50	445	11.2	11.2
BW-003	SV	Benzo(g,h,i)Perylene	470	U	420	U	UU	50	445	11.2	11.2
BW-003	SV	Fluorene	470	U	420	U	UU	50	445	11.2	11.2
BW-003	SV	Naphthalene	470	U	420	U	UU	50	445	11.2	11.2
										-5.1	78.3
BW-003	MTL	Beryllium	0.6	D	0.49	D	DD	0.11	0.545	20.2	20.2
SD-221	MTL	Arsenic	7.3	D	6	D	DD	1.3	6.65	19.5	19.5
BW-003	MTL	Arsenic	5.6	D	4.7	D	DD	0.9	5.15	17.5	17.5
SD-221	MTL	Beryllium	0.61	D	0.57	D	DD	0.04	0.59	6.8	6.8
										16.0	16.0

TABLE 4
Comparison of Background Sediment Data to Remediation Goals
Continental Steel Superfund Site

CLASS	GRP	PARAMETER	SHORT	Remediation Goal	UNITS	WLDCAT	SAMPLE COUNT
Pesticides/PCBs	PPCB	Aroclor-1016	ARO1016	1000	µg/kg	14	12
Pesticides/PCBs	PPCB	Aroclor-1221	ARO1221		µg/kg	14	12
Pesticides/PCBs	PPCB	Aroclor-1282	ARO1232		µg/kg	14	12
Pesticides/PCBs	PPCB	Aroclor-1242	ARO1242	1000	µg/kg	14	12
Pesticides/PCBs	PPCB	Aroclor-1248	ARO1248	1000	µg/kg	14	12
Pesticides/PCBs	PPCB	Aroclor-1254	ARO1254	1000	µg/kg	14	12
Pesticides/PCBs	PPCB	Aroclor-1260	ARO1260	1000	µg/kg	14	12
Semivolatiles	PAH	Acenaphthene	ACEN		µg/kg	14	12
Semivolatiles	PAH	Acenaphthylene	ACENTHYL		µg/kg	14	12
Semivolatiles	PAH	Anthracene	ANTHR		µg/kg	14	12
Semivolatiles	PAH	Benzo(a)Anthracene	BAA	1853	µg/kg	14	12
Semivolatiles	PAH	Benzo(a)Pyrene	BAP	1585	µg/kg	14	12
Semivolatiles	PAH	Benzo(b)Fluoranthene	BBF	1361	µg/kg	14	12
Semivolatiles	PAH	Benzo(g,h,i)Perylene	BghiP		µg/kg	14	12
Semivolatiles	PAH	Benzo(k)Fluoranthene	BKF	1361	µg/kg	14	12
Semivolatiles	PAH	Chrysene	CHRYS		µg/kg	14	12
Semivolatiles	PAH	Dibenzo(a,h)anthracene	DahA		µg/kg	3	3
Semivolatiles	PAH	Fluoranthene	FLANTH		µg/kg	14	12
Semivolatiles	PAH	Fluorene	FLENE		µg/kg	14	12
Semivolatiles	PAH	Indeno(1,2,3-cd)pyrene	I123cdP	930	µg/kg	14	12
Semivolatiles	PAH	Naphthalene	NAPH		µg/kg	14	12
Semivolatiles	PAH	Phenanthrene	PHEN		µg/kg	14	12
Semivolatiles	PAH	Pyrene	PYR		µg/kg	14	12
Total Metals	METAL	Arsenic	AS	19	mg/kg	14	12
Total Metals	METAL	Beryllium	BE	.84	mg/kg	14	12

TABLE 5a
Wildcat Creek Sediment Background Sample Summary
Continental Steel Superfund Site

GRP	P	ParameterDescription	Units	NONDETECT				CENTRAL TENDENCY			CRITERIA	
				D	N	FD	MIN	MAX	MEAN	MED	VALUE	DECRT
METAL	AS	Arsenic	mg/kg	13	14	0.93	2.3	7.37	7.37	4.6	19	1
METAL	BE	Beryllium	mg/kg	11	14	0.79	0.24	0.31	0.19	0.53	0.36	0.44
PAH	FLANTH	Fluoranthene	µg/kg	11	14	0.79	420	460	47	2500	533.43	360
PAH	BBF	Benzo(b)Fluoranthene	µg/kg	10	14	0.71	410	460	43	630	226.43	335
PAH calc	BbKF		µg/kg	10	14	0.71	820	920	70	1210	446.11	1361
PAH	BKF	Benzo(k)Fluoranthene	µg/kg	10	14	0.71	410	460	27	580	219.68	331
PAH	PHEN	Phenanthrene	µg/kg	10	14	0.71	420	700	22	1010	296.93	381
PAH	PYR	Pyrene	µg/kg	10	14	0.71	420	700	42	1400	399.79	407.5
PAH	CHRYS	Chrysene	µg/kg	8	14	0.57	410	700	47	700	278.57	415
PAH	BAA	Benzo(a)Anthracene	µg/kg	7	14	0.50	410	700	62	570	251.50	420
PAH	BAP	Benzo(a)Pyrene	µg/kg	7	14	0.50	410	460	77	710	277.54	420
PAH	I123cdP	Indeno(1,2,3-cd)pyrene	µg/kg	7	14	0.50	410	700	48	410	210.57	410
PAH	ANTHR	Anthracene	µg/kg	5	14	0.36	410	700	24	160	184.07	420
PAH	BghiP	Benzo(g,h,i)Perylene	µg/kg	4	14	0.29	410	700	71	305	216.50	420
PAH	FLENE	Fluorene	µg/kg	2	14	0.14	400	700	43	63	203.64	420
PAH	ACEN	Acenaphthene	µg/kg	14	0.00	400	700	700	700	700	228.93	420
PAH	ACENTHY	Acenaphthylene	µg/kg	14	0.00	400	700	700	700	700	228.93	420
PAH	DanA	Dibenzo(a,h)anthracene	µg/kg	3	0.00	420	530	530	530	530	228.33	420
PAH	NAPH	Naphthalene	µg/kg	14	0.00	400	700	700	700	700	228.93	420
PPCB	ARO1248	Aroclor-1248	µg/kg	3	14	0.21	40	210	59	2000	177.64	43
PPCB	ARO1254	Aroclor-1254	µg/kg	2	14	0.14	40	210	370	1800	165.50	43
PPCB	ARO1260	Aroclor-1260	µg/kg	1	14	0.07	40	210	720	720	78.71	43
PPCB	ARO1221	Aroclor-1221	µg/kg	14	0.00	82	420	420	420	420	58.43	87.5
PPCB	ARO1016	Aroclor-1016	µg/kg	14	0.00	40	210	210	210	210	28.93	43
PPCB	ARO1232	Aroclor-1232	µg/kg	14	0.00	40	210	210	210	210	28.93	43
PPCB	ARO1242	Aroclor-1242	µg/kg	14	0.00	40	210	210	210	210	28.93	43

TABLE 5b
Kokomo Creek Sediment Background Sample Summary
Continental Steel Superfund Site

GRP	P	Units	DETECTION				NONDETECT				EFFECT				CENTRAL				CRITERIA			
			D	N	FD		MIN	MAX			MIN	MAX		MEAN	MEDIAN	MEAN	MEDIAN	VALUE	D ₂	U ₂		
METAL METAL	BE AS	mg/kg mg/kg	11 10	12 12	0.92 0.85		0.59 1.1	0.59	0.1 7	1.1	0.1 4	0.72 4	0.41 2.21	0.55 2.05	0.55 1.9	0.55 1.9	0.55 1.9	0.55 1.9	0.55 1.9	0.55 1.9		
PAH	ACEN	µg/kg	12	12	1.00				60	1300	411.67	310										
PAH	ANTHR	µg/kg	12	12	1.00				110	2900	820.00	525										
PAH	BAA	µg/kg	12	12	1.00				350	7100	2235.83	1475	1853	5								
PAH	BAP	µg/kg	12	12	1.00				320	3700	1806.67	1525	1585	6								
PAH	BBF	µg/kg	12	12	1.00				660	5400	2271.25	1800	1361	9								
PAH	CHRYS	µg/kg	12	12	1.00				380	7600	2606.67	2025										
PAH	DahA	µg/kg	3	3	1.00				290	690	430.00	370										
PAH	FLANTH	µg/kg	12	12	1.00				870	15000	5260.00	3925										
PAH	FLENE	µg/kg	12	12	1.00				55	1500	440.42	272.5										
PAH	I123cdP	µg/kg	12	12	1.00				120	2700	1096.25	815	930	6								
PAH	PHEN	µg/kg	12	12	1.00				660	13000	4067.50	2750										
PAH	PYR	µg/kg	12	12	1.00				1200	11000	4650.00	3650										
PAH _{calc}	Bbkf	µg/kg	10	12	0.83				1040	2070	1540	10800	3804.58	3200	1361	10	1					
PAH	BghiP	µg/kg	10	12	0.83				380	1800	86	1460	631.33	470								
PAH	BKF	µg/kg	10	12	0.83				380	470	540	5400	1627.50	1392.5	1361	7						
PAH	NAPH	µg/kg	4	12	0.33				380	1400	27	240	251.33	405								
PAH	ACENTHY	µg/kg	3	12	0.25				380	1800	28	154.5	329.33	440								
PPCB	ARO1248	µg/Kg	8	12	0.67				38	690	210	490	265.75	340	1900							
PPCB	ARO1016	µg/kg	12	900	0.00				38	120			34.65	66	1000							
PPCB	ARO1221	µg/kg	12	900	0.00				78	240			70.44	134.75								
PPCB	ARO1232	µg/kg	12	900	0.00				38	120			34.65	66								
PPCB	ARO1242	µg/kg	12	900	0.00				38	120			34.65	66	1000							
PPCB	ARO1254	µg/Kg	12	900	0.00				38	120			34.65	66	1000							
PPCB	ARO1260	µg/kg	12	900	0.00				38	250			41.19	66	1000							

TABLE 6a
Kokomo Creek Sediment Background Estimates
Continental Steel Superfund Site

GRP	PARAMETER	SHORT	UNITS	DETECTION FREQUENCY				CENTRAL TENDENCY		UPPER TOLERANCE	
				FD	UL	CONG	UCL	UTL	UL	5.4	7.0 [34%]
METAL	Arsenic	AS	mg/kg	0.012	NP	0.83	0.98	2.1	3.4 [34%]	1097	1300 [34%]
METAL	Beryllium	BE	mg/kg	0.043	NP	0.92	1.00	0.65	0.67 [91%]	0.70	0.72 [34%]
PAH	Acenaphthene	ACEN	µg/kg	0.016	NP	0.00	0.21	0.10	0.57 [91%]	1014	1519
PAH	Acenaphthylene	ACENTHYL	µg/kg	0.106	NP	0.25	0.57	1.12	1.24	2900 [34%]	2900 [34%]
PAH	Anthracene	ANTHR	µg/kg	0.002	NP	1.00	0.78 >	5.25	38.0 [91%]	1979	7100 [34%]
PAH	Benz(a)Anthracene	BAA	µg/kg	0.008	NP	1.00	0.78 >	14.76	30.0 [91%]	5159	7100 [34%]
PAH	Benz(a)Pyrene	BAP	µg/kg	0.001	NP	1.00	0.78 >	1.87	24.6	3462	4849
PAH	Benz(b)Fluoranthene	BBF	µg/kg	0.004	NP	1.00	0.78 >	2.27	22.12	4706	6746
PAH	BbkF	BghiP	µg/kg	0.056	NP	0.83	0.98	3.94	5.63 [91%]	8347	12046
PAH	Benz(g,h,i)Perylene	BKF	µg/kg	0.112	NP	0.83	0.98	1.22	1.27	1616	2365
PAH	Benz(k)Fluoranthene	CHRYS	µg/kg	0.006	NP	0.83	0.98	1.66	2.53	3880	5739
PAH	Chrysene	DahA	µg/kg	0.029	NP	1.00	0.78 >	2.05	3.60	5758	7600
PAH	Dibenz(o,a,h)anthracene	FLANTH	µg/kg	0.044	NP	1.00	0.27 >	3.70	6.90 [91%]	658	690 [0%]
PAH	Fluoranthene	FLENE	µg/kg	0.002	NP	1.00	0.78 >	2.25	7.80 [91%]	11425	15000 [34%]
PAH	Florene	I123cdP	µg/kg	0.196	NP	1.00	0.78 >	6.96	12.72	1272	15000 [34%]
PAH	Indeno(1,2,3-cd)pyrene	NAPH	µg/kg	0.062	NP	0.33	0.65	4.59	6.96	2393	3480
PAH	Naphthalene	PHEN	µg/kg	0.009	NP	1.00	0.78 >	2.50	5.60 [91%]	1073	1587
PAH	Phenanthrene	PYR	µg/kg	0.259	NP	1.00	0.78 >	4.59	8.90	10333	13000 [34%]
PAH	Pyrene									9414	13407
PPCB	Aroclor-1221	ARO1221	µg/kg	0.037	NP	0.00	0.21	0.6	9.3 [91%]	105	120 [34%]
PPCB	Aroclor-1016	ARO1016	µg/kg	0.039	NP	0.00	0.21	1.35	1.46 [91%]	213	240 [34%]
PPCB	Aroclor-1232	ARO1232	µg/kg	0.042	NP	0.00	0.21	0.2	9.3 [91%]	107	120 [33%]
PPCB	Aroclor-1242	ARO1242	µg/kg	0.039	NP	0.00	0.21	0.6	9.3 [91%]	105	120 [34%]
PPCB	Aroclor-1248	ARO1248	µg/kg	0.067	NP	0.67	0.89	2.23	4.02	632	937
PPCB	Aroclor-1254	ARO1254	µg/kg	0.039	NP	0.00	0.21	0.6	9.3 [91%]	105	120 [34%]
PPCB	Aroclor-1260	ARO1260	µg/kg	0.001	NP	0.00	0.21	0.6	9.3 [91%]	179	250 [34%]

N = NORMAL

NP = NONPARAMETRIC

TABLE 6b
Wildcat Creek Sediment Background Estimates
Continental Steel Superfund Site

GRP	PARAMETER	SHORT	UNITS	DETECTION		CENTRAL		UPPER	
				SW GOF	DISTRIBU-TION	FREQUENCY	TENDENCY	UTL	TOLERANCE
METAL	Arsenic	AS	mg/kg	E-4	NP	0.36	4.7	12.3 [94%]	21.2
METAL	Beryllium	BE	mg/kg	E-028	NP	0.98	0.45	0.94 [94%]	32.3 [35%]
PAH	Acenaphthene	ACEN	µg/kg	E-4	NP	0.00	0.21	420	510 [94%]
PAH	Acenaphthylene	ACENTHYL	µg/kg	E-4	NP	0.00	0.21	420	510 [94%]
PAH	Anthracene	ANTHR	µg/kg	0.115	N	0.36	0.68	225	310 [94%]
PAH	Benzo(a)Anthracene	BAA	µg/kg	0.098	N	0.54	0.81	360	475
PAH	Benzo(a)Pyrene	BAP	µg/kg	0.297	N	0.54	0.81	380	483
PAH	Benzo(b)Fluoranthene	BBF	µg/kg	0.092	N	0.77	0.95	274	393
PAH	Benzo(b&k)Fluoranthene	BbkF	µg/kg	0.071	N	0.77	0.95	641	782
PAH	Benzo(g,h,i)Perylene	BghiP	µg/kg	0.129	N	0.31	0.61	377	473
PAH	Benzo(k)Fluoranthene	BKF	µg/kg	0.045	NP	0.77	0.95	303	420 [94%]
PAH	Chrysene	CHRYS	µg/kg	0.189	N	0.62	0.86	379	516
PAH	Dibenz(a,h)anthracene	DahA	µg/kg	NA	NP	0.00	0.63	220	330 [75%]
PAH	Fluoranthene	FLANTH	µg/kg	E-4	NP	0.85	0.98	310	420 [94%]
PAH	Fluorene	FLENE	µg/kg	0.014	NP	0.15	0.45	420	450 [94%]
PAH	Indeno(1,2,3-cd)pyrene	I123cdP	µg/kg	0.147	N	0.54	0.81	317	432
PAH	Naphthalene	NAPH	µg/kg	E-4	NP	0.00	0.21	420	510 [94%]
PAH	Phenanthrene	PHEN	µg/kg	0.117	N	0.77	0.95	351	552
PAH	Pyrene	PYR	µg/kg	0.062	N	0.77	0.95	472	708
PPCB	Aroclor-1016	ARO1016	µg/kg	E-8	NP	0.00	0.21	42	53 [92%]
PPCB	Aroclor-1221	ARO1221	µg/kg	E-6	NP	0.00	0.21	85	110 [54%]
PPCB	Aroclor-1232	ARO1232	µg/kg	E-6	NP	0.00	0.21	42	53 [94%]
PPCB	Aroclor-1242	ARO1242	µg/kg	E-5	NP	0.00	0.21	42	53 [94%]
PPCB	Aroclor-1248	ARO1248	µg/kg	E-5	NP	0.15	0.45	42	53 [92%]
PPCB	Aroclor-1254	ARO1254	µg/kg	E-6	NP	0.08	0.36	42	53 [94%]
PPCB	Aroclor-1260	ARO1260	µg/kg	E-6	NP	0.00	0.21	42	53 [94%]

N = NORMAL

NP = NONPARAMETRIC

Shapiro-Wilk Test for Normality

$$H_0: F(x) \sim N(\mu, \sigma^2)$$

$$H_1: F(x) \not\sim N$$

Assumptions

Assumes sample is random sample.

Test Statistic [T₃]

$$T_3 = \left[\sum_{i=1, \dots, k} a_i (X^{(n-i+1)} - X^{(i)}) \right]^2 / \sum_{i=1, \dots, n} (X_i - \bar{X})^2$$

where:

n = sample size

k ~ n/2

a_i = tabled coefficients based upon n and desired alpha [α]
[Table A17]

X_i = i-th observation--1 of n observed values

\bar{X} = sample mean

X⁽ⁱ⁾ = Ordered sample such that $X^{(1)} \leq X^{(2)} \leq \dots \leq X^{(n)}$

Decision Rule

Reject at significance α if $T_3 < \alpha$ given in Table A18. Alternatively, for increased precision, calculate G:

$$G = b_n + c_n \ln(T_3 - d_n / 1 - T_3)$$

where:

b_n, c_n and d_n = tabled values

[Table A19]

G is approximately standard normal and compared to critical values

[Table A1]

Test Variations

[1] To test

$$H_0: F(x) \sim \log N(\mu, \sigma^2)$$

$$H_1: F(x) \not\sim \log N$$

Conduct S-W on log of observations.

[2] To test several independent samples for *goodness-of-fit* when several [m] small samples [from possibly different populations] are insufficient <individually> to reject

the null hypothesis of normality

Conduct S-W individually on each of m samples. Convert T₃-values for each of m samples to G-values [above]. Sum the m G-values and divide by m^{.5} which is approximately Z, standard normal under the null hypothesis. Test against critical values found in standard Normal tables [Table A1].

Confidence Interval Calculations

Normally-distributed data

Calculate sample mean and standard deviation or error. Apply conventional 1-sided upper confidence limits [UCL], calculated as:

$$UCL = \bar{X} + Z_{1-\alpha} (\sigma / (n)^{.5})$$

where:

$$\begin{aligned}\bar{X} &= \sum_{i=1, 2, \dots, n} X_i / n \\ \sigma &= [\sum (X_i - \bar{X})^2 / (n-1)]^{.5} \\ (n)^{.5} &= \text{sq rt of count of observations}\end{aligned}$$

LogNormally-distributed data

Calculate sample mean and standard error using log transformed values. Use Land's tables to calculate 1-sided upper confidence limits:

$$UCL = \exp \left(\bar{y} + 0.5 s_y^2 + (s_y H_{1-\alpha} / (n-1)^{.5}) \right)$$

where:

$$\begin{aligned}\bar{Y} &= \sum_{i=1, 2, \dots, n} y_i / n \\ s_y^2 &= \sum (y_i - \bar{Y})^2 / (n-1) \\ y_i &= \ln x_i \\ H_{1-\alpha} &= \text{tabled values } f(n, s_y^2 \text{ and } \alpha) \\ &\quad [\text{Tables A10-A13}]\end{aligned}$$

NonNormal data

For samples > 20 , use Table A3' to find the specified α for an upper confidence limit on the $q=.5$ (median) or calculate the order statistic for the one-sided limit, as:

$$s^* = np^* + w_{1-\alpha} (np^*(1-p^*))^{.5}$$

where:

$$\begin{aligned}p^* &= \text{quantile of interest [here, 0.5]} \\ (np^*(1-p))^{\cdot5} &= \text{sq rt of } (n)(p^*)(1-p^*) \\ w_{1-\alpha} &= \text{Normal score for specified } p^*, n \text{ & } \alpha\end{aligned}$$

The UL on the median is the measure corresponding to the order statistic rounded up to the integer above the calculated s^* .

Tolerance Interval Calculations

Normally-distributed data

Calculate sample mean [X] and standard deviation [σ]. Apply conventional 1-sided upper tolerance limits [UTL], calculated as:

$$UTL = \bar{X} + K(\sigma)$$

where:

$$\bar{X} = \sum_{i=1, 2, \dots, n} X_i / n$$

$$\begin{aligned}\sigma &= [\sum (X_i - \bar{X})^2 / (n-1)]^{.5} \\ K &= \text{tolerance factor}\end{aligned}$$

LogNormally-distributed data

Calculate sample mean and standard deviation using log transformed values. Use Land's tables to calculate 1-sided upper confidence limits:

$$UTL = \exp(\bar{Y} + K(s_y))$$

where:

$$\bar{Y} = \sum_{i=1, 2, \dots, n} y_i / n$$

$$\begin{aligned}s_y^2 &= \sum (y_i - \bar{Y})^2 / (n-1) \\ y_i &= \ln x_i\end{aligned}$$

NonNormal data

For samples > 20 , use statistical tables to find the specified α for an upper tolerance limit on the $q=.95$ percentile of the distribution or calculate the order statistic for the one-sided limit, as:

$$s^* = np^* + w_{1-\alpha} (np^*(1-p^*))^{.5}$$

where:

$$p^* = \text{quantile of interest [here, 0.95]}$$

$$(np^*(1-p^*))^{.5} = \text{sq rt of } (n)(p^*)(1-p^*)$$

$$w_{1-\alpha} = \text{Normal score for specified } p^*, n \text{ & } \alpha$$

The UL on the 95th percentile the measure corresponding to the order statistic rounded up to the integer above the calculated s^* .

